PB-239 594

TAINTER LAKE, DUNN COUNTY, WISCONSIN

Pacific Northwest Environmental Research Laboratory

Prepared for:

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Wisconsin Department of Natural Resources
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16. ABSTRACT
Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivded according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
eutrophication lakes nutrients phosphorus nitrogen loading		05B 05C

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REPORT

ON

TAINTER LAKE

DUNN COUNTY

WISCONSIN

EPA REGION V

WORKING PAPER No. 51

WITH THE COOPERATION OF THE

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

AND THE

WISCONSIN NATIONAL GUARD

OCTOBER, 1974

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to fresh water lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Wisconsin Department of Natural Resources for professional involvement and to the Wisconsin National Guard for conduct of the tributary sampling phase of the Survey.

Francis H. Schraufnagel, Acting Assistant Director, and Joseph R. Ball of the Bureau of Water Quality, and Donald R. Winter, Lake Rehabilitation Program, provided invaluable lake documentation and counsel during the Survey. Central Office and District Office personnel of the Department of Natural Resources reviewed the preliminary reports and provided critiques most useful in the preparation of this Working Paper series.

Major General James J. Lison, Jr., the Adjutant General of Wisconsin, and Project Officer CW-4 Donald D. Erickson, who directed the volunteer efforts of the Wisconsin National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

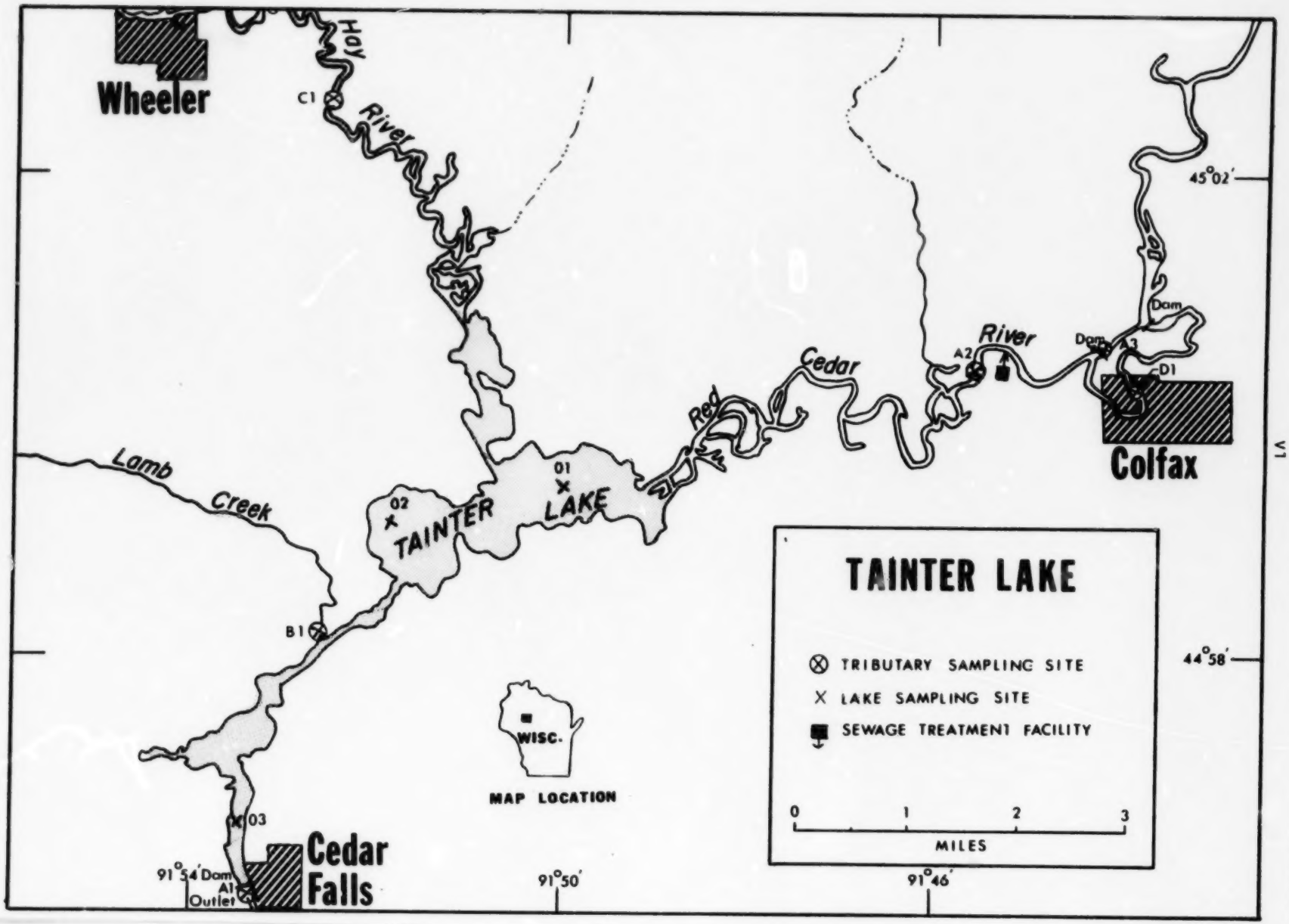
NATIONAL EUTROPHICATION SURVEY

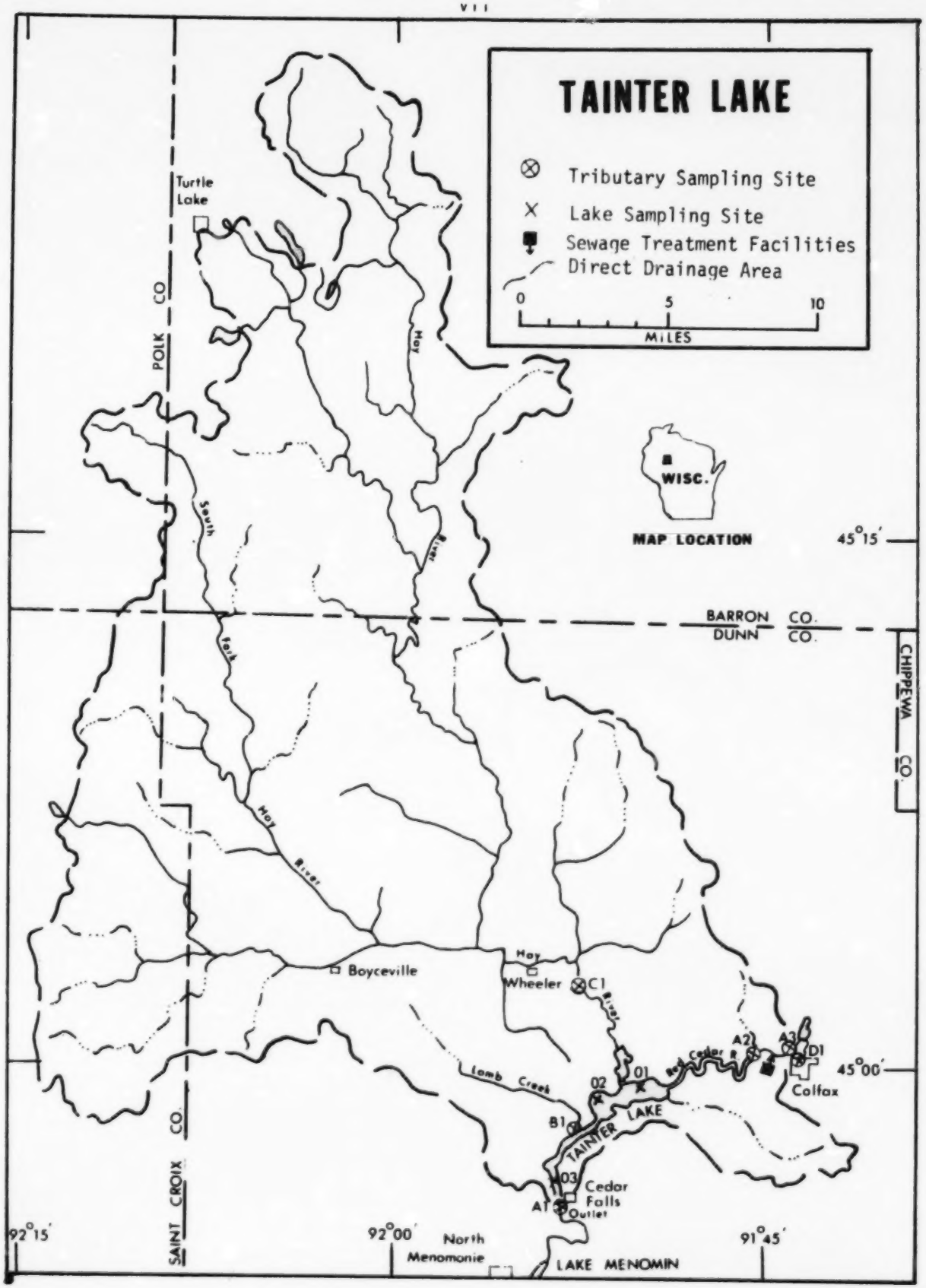
STUDY LAKES

STATE OF WISCONSIN

LAKE NAME	COUNTY
Altoona	Eau Claire
Beaver Dam	Barron
Beaver Dam	Dodge
Big Eau Pleine	Marathon
Browns	Racine
Butte des Morts	Winnebago
Butternut	Price, Ashland
Castle Rock Flowage	Juneau
Como	Walworth
Crystal	Vilas
Delavan	Walworth
Eau Claire	Eau Claire
Elk	Price
Geneva	Walworth
Grand	Green Lake
Green	Green Lake
Kegonsa	Dane
Koshkonong	Jefferson, Rock, Dane
Lac La Belle	Waukesha
Long	Price
Middle	Walworth
Nagawicka	Waukesha
Oconomowoc	Waukesha
Okauchee	Waukesha
Petenwell Flowage	Juneau
Pewaukee	Waukesha
Pigeon	Waupaca
Pine	Waukesha
Poygan	Winnebago, Waushara
Rock	Jefferson
Rome Pond	Jefferson, Waukesha
Round	Waupaca
Shawano	Shawano

LAKE NAME	COUNTY
Sinnissippi	Dodge
Swan	Columbia
Tainter	Dunn
Tichigan	Racine
Townline	Oneida
Trout	Vilas
Wapogassett	Polk
Wausau	Marathon
Willow	Oneida
Winnebago	Winnebago, Fond Du Lac, Calumet
Wisconsin	Columbia
Wissota	Chippewa
Yellow	Burnett


Wheeler
Hay
River
C1
Cedar
River
A2
Dam
A3
Dam
D1
Colfax
45°02'
Red
Lamb
Creek
02
TAINTER
01
LAKE
B1
44°58'
TAINTER LAKE
TRIBUTARY SAMPLING SITE
LAKE SAMPLING SITE
SEWAGE TREATMENT FACILITY
0
1
2
3
MILES
WISC.
MAP LOCATION
03
Cedar
Falls
91°54'
Dam
A1
Outlet
91°50'
91°46'


TAINTER LAKE
Tributary Sampling Site
Lake Sampling Site
Sewage Treatment Facilities
Direct Drainage Area
0
5
10
MILES
WISC.
MAP LOCATION
Turtle Lake
POLK CO
Hay
South Fork
Hay River
BARRON CO.
DUNN CO.
CHIPPEWA CO.
45°15'
Boyceville
Hay
Wheeler
C1
Hay River
Lamb Creek
Cedar R.
A2
A3
D1
45°00'
Colfax
02
01
B1
TAINTER LAKE
H03
Cedar Falls Outlet
A1
SAINT CROIX CO.
92°15'
92°00'
North Menomonie
LAKE MENOMIN
91°45'

TAINTER LAKE

STORET NO. 5546

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Tainter Lake is eutrophic.

B. Rate-Limiting Nutrient:

Because of a significant loss of nitrogen in the assay sample, the results are not reliable (see page 8). The lake data indicate phosphorus limitation in November but nitrogen limitation in June and August.

C. Nutrient Controllability:

1. Point sources--During the sampling year, Tainter Lake received a total phosphorus load at a rate far in excess of that proposed by Vollenweider (in press) as "dangerous"; i.e., a eutrophic rate (see page 14). However, Survey data indicate that less than one percent of the phosphorus load was from point sources (neglecting an undefined load from the Colfax Cooperative Creamery and point sources beyond the Survey limits), and it is concluded that point-source phosphorus control would have little effect on the trophic condition of Tainter Lake. Note that if the entire Tainter Lake drainage had a phosphorus export equal to that of apparently unimpacted Lamb Creek, the lake still would have received a total phosphorus load at a rate nearly five times the eutrophic rate.

2. Non-point sources--Areal or non-point sources appear to be contributing high amounts of phosphorus to Tainter Lake. For example, the total phosphorus export of Lamb Creek, which does not appear to be impacted by any point sources at all, was 104 lbs/mi^2 of drainage during the sampling year (see page 14). However, the phosphorus export of the Red Cedar River was over twice that of Lamb Creek; this probably is due to underestimation of the Colfax contribution as well as unmeasured point-source contributions further upstream in the rather extensive Red Cedar drainage basin.

II. INTRODUCTION

Tainter Lake, Dunn County, is part of the lower Chippewa River drainage which is tributary to the Mississippi River. The topography of the basin is primarily rolling glacial terrain.

Recreational uses of the lake include swimming, boating, and fishing. Game fish present are northern pike, walleyes, largemouth bass, and panfish.

Much of the shoreline is developed, and 16 resorts provide boat rentals and services. Public access is provided.

III. LAKE AND DRAINAGE BASIN CHARACTERISTICS

A. Lake Morphometry*:

1. Surface area: 1,692 acres.
2. Mean depth: 13.3 feet.
3. Maximum depth: 37 feet.
4. Volume: 22,543 acre/feet.
5. Mean hydraulic retention time: 10 days.

B. Tributary and Outlet:
(See Appendix A for flow data)

1. Tributaries -

Name	Drainage area†	Mean flow†
Red Cedar River	1,140.0 mi^2	790.8 cfs
Hay River	466.0 mi^2	300.0 cfs
Lamb Creek	18.3 mi^2	9.0 cfs
Minor tributaries & immmediate drainage -	53.0 mi^2	29.5 cfs
Totals	1,677.3 mi^2	1,129.3 cfs

2. Outlet -

Red Cedar River	1,680.0 mi^{2}††	1,129.3 cfs

C. Precipitation†††:

1. Year of sampling: 30.9 inches.
2. Mean annual: 28.8 inches.

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* Dept. of Natural Resources 1960 lake survey map; recalculated in 1973.
† Drainage areas are accurate within ±0.5%; mean daily flows are accurate within ±40%; mean monthly flows are accurate within ±35%; and normalized monthly flows are accurate within ±35%.
†† Includes area of lake.
††† See Working Paper No. 1, "Survey Methods".

IV. LAKE WATER QUALITY SUMMARY

Tainter Lake was sampled three times during the open-water season of 1972 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from three stations on the lake and from a number of depths at each station (see map, page vi). During each visit, a single depth-integrated (15 feet or near bottom to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the last visit, a single five-gallon depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll *a* analysis. The maximum depths sampled were 7 feet at station 1, 15 feet at station 2, and 30 feet at station 3.

The results obtained are presented in full in Appendix B, and the data for the fall sampling period, when the lake was essentially well-mixed, are summarized below. Note, however, the Secchi disc summary is based on all values.

For differences in the various parameters at the other sampling times, refer to Appendix B.

A. Physical and chemical characteristics:

Parameter	Minimum	Mean	Median	Maximum
		FALL VALUES (11/03/72)		
Temperature (Cent.)	4.9	5.2	5.2	5.3
Dissolved oxygen (mg/l)	11.6	11.8	11.7	12.2
Conductivity (μmhos)	140	177	184	190
pH (units)	7.5	7.8	7.8	7.9
Alkalinity (mg/l)	51	68	71	74
Total P (mg/l)	0.089	0.112	0.099	0.174
Dissolved P (mg/l)	0.051	0.057	0.054	0.073
$NO_2 + NO_3$ (mg/l)	0.680	0.704	0.705	0.720
Ammonia (mg/l)	0.050	0.071	0.065	0.100
		ALL VALUES		
Secchi disc (inches)	30	55	48	90

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Number per ml
06/26/72	1. Melosira	1,232
	2. Cyclotella	966
	3. Nitzschia	821
	4. Scenedesmus	725
	5. Synedra	483
	Other genera	1,473
	Total	5,700
08/26/72	1. Cyclotella	760
	2. Navicula	515
	3. Melosira	235
	4. Cocconeis	217
	5. Anabaena	127
	Other genera	804
	Total	2,658
11/03/72	1. Flagellates	648
	2. Cyclotella	467
	3. Asterionella	437
	4. Synedra	241
	5. Cryptomonas	226
	Other genera	1,567
	Total	3,586

2. Chlorophyll a -
(Because of instrumentation problems during the 1972 sampling, the following values may be in error by plus or minus 20 percent.)

Sampling Date	Station Number	Chlorophyll a (µg/l)
06/26/72	01	31.1
	02	20.4
	03	21.6
08/26/72	01	1.5
	02	2.1
	03	2.8
11/03/72	01	14.4
	02	12.0
	03	17.1

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.065	0.528	16.8
0.006 P	0.071	0.528	14.0
0.012 P	0.077	0.528	13.2
0.024 P	0.089	0.528	13.2
0.060 P	0.125	0.528	12.4
0.060 P + 10.0 N	0.125	10.528	55.0
10.0 N	0.065	10.528	25.2

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that potential primary productivity of Tainter Lake was high at the time the sample was collected. Also, the results indicate the lake was nitrogen limited. However, there was a significant loss of inorganic nitrogen

(247 µg/l) in the sample from the time of collection until the assay was begun; and the results, therefore, are considered unreliable.

Had the loss not occurred, it is most likely the sample would have been phosphorus limited. The lake data support this conclusion. The mean nitrogen to phosphorus ratio for all November samples was 14 to 1 and was 12 to 1 at station 1, 14 to 1 at station 2, and 14 to 1 at station 3 (i.e., phosphorus limitation would be expected).

The lake data also indicate Tainter Lake may be nitrogen limited at times. The N/P ratios at the other sampling times were 7/1 or less at all stations.

D. Trophic Condition:

Survey data indicate Tainter Lake is eutrophic. Despite the very short hydraulic retention time of this lake, of the 46 Wisconsin lakes studied, 38 had less mean total and dissolved phosphorus, 38 had less mean inorganic nitrogen, 24 had less mean chlorophyll a, and 19 had greater Secchi disc transparency.

V. NUTRIENT LOADINGS
(See Appendix C for data)

For the determination of nutrient loadings, the Wisconsin National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page vii) except for the high runoff months of April and May, when two samples were collected at most stations, and during the colder months of the year when one or more samples were omitted at some stations because of low flow and/or ice cover. Sampling was begun in September, 1972, and was completed in September, 1973.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Wisconsin District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were determined by using the pounds per square mile per year calculated for Lamb Creek at B-1 and multiplying that by the ZZ area in square miles.

The City of Colfax declined participation in the Survey, and nutrient loads attributed to that source were estimated (as municipal wastes only) at 2.5 lbs P and 7.5 lbs N/capita/year.

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* See Working Paper No. 1.

Since no information on the contribution of the Colfax Cooperative Creamery to the Colfax wastewater treatment plant was available, the loads attributed to Colfax are not adjusted for the industrial loads.

Loads attributed to the Red Cedar River are those measured at A-2 minus the loads estimated for the Colfax STP.

A. Waste Sources:

1. Known municipal -

Name	Pop. Served	Treatment	Mean Flow (mgd)	Receiving Water
Colfax	973*	trickling filter	0.225**	Red Cedar River

2. Known industrial** -

Name	Product	Treatment	Mean Flow (mgd)	Receiving Water
Colfax Coop. Creamery	Dairy products	Colfax STP	?	Red Cedar River

* 1970 Census.
** McKersie, et al., 1971.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	lbs P/ yr	% of total
a. Tributaries (non-point load) -		
Red Cedar River	239,770	78.2
Hay River	56,480	18.4
Lamb Creek	1,910	0.6
b. Minor tributaries & immediate drainage (non-point load) -	5,510	1.8
c. Known municipal STP's -		
Colfax	2,430	0.8
d. Septic tanks* -	130	<0.1
e. Known industrial -		
Colfax Coop. Creamery	? (to Colfax STP)	
f. Direct precipitation** -	270	<0.1
Total	306,490	100.0

2. Outputs -

Lake outlet - Red Cedar River 268,250

3. Net annual P accumulation - 38,240 pounds

* One campground, 16 resorts, and 40 dwellings on lakeshore; see Working Paper No. 1.
** See Working Paper No. 1.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	lbs N/ yr	% of total
a. Tributaries (non-point load) -		
Red Cedar River	2,313,700	66.3
Hay River	1,043,590	29.9
Lamb Creek	26,980	0.8
b. Minor tributaries & immediate drainage (non-point load) -	78,120	2.2
c. Known municipal STP's -		
Colfax	7,300	0.2
d. Septic tanks* -	4,860	0.1
e. Known industrial -		
Colfax Coop. Creamery	? (to Colfax STP)	
f. Direct precipitation** -	16,300	0.5
Total	3,490,850	100.0

2. Outputs -

Lake outlet - Red Cedar River 3,469,900

3. Net annual N accumulation - 20,950 pounds

* One campground, 16 resorts, and 40 dwellings on lakeshore; see Working Paper No. 1.
** See Working Paper No. 1.

D. Mean Annual Non-point Nutrient Export by Subdrainage Area:

Tributary	lbs P/mi^2/yr	lbs N/mi^2/yr
Red Cedar River	210	2,030
Hay River	121	2,239
Lamb Creek	104	1,474

E. Yearly Loading Rates:

In the following table, the existing phosphorus loading rates are compared to those proposed by Vollenweider (in press). Essentially, his "dangerous" rate is the rate at which the receiving waters would become eutrophic or remain eutrophic; his "permissible" rate is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic rate would be considered one between "dangerous" and "permissible".

Units	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
lbs/acre/yr	181.1	22.6	2,063.2	12.4
grams/m^2/yr	20.30	2.53	231.2	1.4

Vollenweider loading rates for phosphorus (g/m^2/yr) based on mean depth and mean hydraulic retention time of Tainter Lake:

"Dangerous" (eutrophic rate)	2.30
"Permissible" (oligotrophic rate)	1.15

VI. LITERATURE REVIEWED

Anonymous, 1972. Wisconsin lakes. Publ. 218-72, Dept. of Natural Resources, Madison.

Ball, Joseph, 1974. Personal communication (Tainter Lake shoreline development). Dept. of Natural Resources, Madison.

McKersie, Jerome R., Robert M. Krill, Charles Kozel, and Danny J. Ryan, 1971. Lower Chippewa River pollution investigation. Dept. of Natural Resources, Madison.

Vollenweider, Richard A., (in press). Input-output models. Schweiz. A. Hydrol.

VII. APPENDICES

APPENDIX A

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR WISCONSIN 9/30/74

LAKE CODE 5546 TAINTER LAKE

TOTAL DRAINAGE AREA OF LAKE 1680.00

TRIBUTARY	SUB-DRAINAGE AREA	NORMALIZED FLOWS JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
5546A1	1680.00	772.40	808.00	1687.00	2042.20	1243.10	1243.10	1509.50	799.20	976.80	808.10	888.00	763.70	1129.31
5546A2	1140.00	520.00	570.00	1200.00	1600.00	930.00	930.00	710.00	600.00	710.00	570.00	600.00	550.00	790.79
5546B1	18.30	2.90	4.60	13.00	33.00	9.80	9.80	6.10	8.40	6.10	4.60	2.90	6.40	8.96
5546C1	466.00	170.00	200.00	460.00	700.00	350.00	350.00	260.00	240.00	260.00	200.00	190.00	220.00	300.00
5546ZZ	55.70	12.00	17.00	44.00	94.00	33.00	33.00	22.00	27.00	22.00	17.00	12.00	21.00	29.48

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 1680.00
SUM OF SUB-DRAINAGE AREAS = 1680.00

TOTAL FLOW IN = 13551.58
TOTAL FLOW OUT = 13541.09

MEAN MONTHLY FLOWS AND DAILY FLOWS

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
5546A1	9	72	1200.00	24	1100.00				
	10	72	1400.00	23	1300.00				
	11	72	1400.00	28	1300.00				
	12	72	980.00	21	1100.00				
	1	73	1070.00	28	1110.00				
	2	73	1000.00	23	1020.00				
	3	73	4050.00	22	3260.00				
	4	73	1590.00	7	1680.00	23	1270.00		
	5	73	2380.00	14	1960.00	29	3330.00		
	6	73	1490.00	28	1020.00				
	7	73	956.00	23	920.00				
	8	73	980.00						
5546A2	9	72	840.00	24	760.00				
	10	72	990.00	23	990.00				
	11	72	1000.00	28	840.00				
	12	72	770.00	31	800.00				
	1	73	740.00	28	740.00				
	2	73	700.00	23	720.00				
	3	73	2700.00	22	2200.00				
	4	73	1100.00	7	1200.00	23	880.00		
	5	73	1600.00	14	1300.00	29	2100.00		
	6	73	990.00	28	680.00				
	7	73	640.00	23	660.00				
	8	73	630.00						

TRIBUTARY FLOW INFORMATION FOR WISCONSIN 9/30/74

LAKE CODE 5546 TAINTER LAKE

MEAN MONTHLY FLOWS AND DAILY FLOWS

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
554681	9	72	11.00	24	11.00				
	10	72	13.00	23	13.00				
	11	72	12.00	28	8.00				
	12	72	8.20	31	9.00				
	1	73	4.50	28	4.50				
	2	73	5.40	23	5.60				
	3	73	30.00	22	24.00				
	4	73	24.00	7	21.00	23	20.00		
	5	73	19.00	14	15.00	29	20.00		
	6	73	12.00	28	8.10				
	7	73	9.20	23	9.00				
	8	73	6.00						
5546C	9	72	360.00	24	300.00				
	10	72	390.00	23	390.00				
	11	72	400.00	28	310.00				
	12	72	280.00	21	280.00				
	1	73	290.00	28	330.00				
	2	73	290.00	23	310.00				
	3	73	1200.00	22	700.00				
	4	73	430.00	7	390.00	23	430.00		
	5	73	690.00	14	530.00	29	660.00		
	6	73	400.00	28	300.00				
	7	73	260.00	23	260.00				
	8	73	260.00						
5546ZZ	9	72	36.00	24	33.00				
	10	72	40.00	23	40.00				
	11	72	39.00	28	28.00				
	12	72	27.00	21	26.00	31	29.00		
	1	73	17.00	28	17.00				
	2	73	20.00	23	20.00				
	3	73	98.00	22	78.00				
	4	73	67.00	7	60.00	23	57.00		
	5	73	54.00	14	50.00	29	68.00		
	6	73	39.00	28	28.00				
	7	73	29.00	23	28.00				
	8	73	22.00						

APPENDIX B

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 74/09/30

554601
44 59 18.0 091 50 00.0
TAINTER LAKE
55 WISCONSIN

11EPALES
3

2111202
0009 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/06/26	17 25	0000	23.2	11.4	42	170	9.00	71	0.220	0.060	0.115	0.089
	17 25	0007	21.5	9.0		155	7.80	61	0.400	0.130	0.156	0.118
72/08/26	14 50	0000			60	135	7.60	56	0.700	0.080	0.161	0.122
	14 50	0004	17.9	9.3		140	7.60	56	0.680	0.080	0.160	0.120
72/11/03	16 00	0000			30	140	7.50	51	0.720	0.100	0.174	0.073
	16 00	0004	4.9	11.7		150	7.60	53	0.720	0.100	0.165	0.068

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/06/26	17 25	0000	31.1J
72/08/26	14 50	0000	1.5J
72/11/03	16 00	0000	14.4J

J VALUE KNOWN TO BE IN ERROR

STORET RETRIEVAL DATE 74/09/30

554602
44 59 00.0 091 51 30.0
TAINTER LAKE
55 WISCONSIN

11EPALES 2111202
3 0015 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/06/26	17 45	0000	23.5	18.8	36	170	9.30	72	0.060	0.080	0.097	0.062
	17 45	0015	18.5	8.8		230	7.90	98	0.380	0.240	0.060	0.097
72/08/26	12 20	0000			90	160	7.90					
	12 20	0004	20.6	15.4		163	7.90	76	0.400	0.140	0.116	0.095
	12 20	0010	20.1	7.8		168	7.90	74	0.400	0.120	0.118	0.097
	12 20	0015	19.1	7.5		162	7.75	72	0.550	0.150	0.151	0.089
72/11/03	16 10	0000			48	180	7.80	69	0.710	0.060	0.102	0.057
	16 10	0004	5.1	11.6		175	7.80	70	0.710	0.060	0.114	0.052
	16 10	0014	5.1	11.6		180	7.80	70	0.700	0.060	0.103	0.055

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/06/26	17 45	0000	20.4J
72/08/26	12 20	0000	2.1J
72/11/03	16 10	0000	12.0J

J VALUE KNOWN TO BE IN ERROR

STORET RETRIEVAL DATE 74/09/30

554603 1
44 56 36.0 091 53 30.0
TAINTER LAKE
55 WISCONSIN

11EPALES 2111202
3 0026 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/06/26	18	15 0000	21.0	11.4	48	180	9.20	78	0.110	0.070	0.084	0.060
	18	15 0015	19.3	10.1		180	8.50	78	0.270	0.210	0.094	0.074
	18	15 0024	19.0	9.0		180	8.20	75	0.290	0.200	0.097	0.073
72/08/26	15	10 0000			81	173	7.85	73	0.330	0.200	0.121	0.096
	15	10 0004	21.9	7.0		175	7.85	74	0.320	0.220	0.113	0.091
	15	10 0010	22.0	6.9		175	7.80	73	0.330	0.230	0.107	0.092
	15	10 0015	22.0	7.0		175	7.85	73	0.330	0.230	0.111	0.090
	15	10 0020	21.9	6.8		175	7.85	74	0.320	0.220	0.109	0.090
	15	10 0025	20.8	6.2		180	7.60	76	0.420	0.220	0.114	0.097
	15	10 0030	19.8	5.2		181	7.50	78	0.490	0.360	0.135	0.081
72/11/03	16	25 0000			56	190	7.90	72	0.690	0.070	0.091	0.051
	16	25 0004	5.2			190	7.90	73	0.700	0.070	0.091	0.051
	16	25 0015	5.3	11.8		190	7.80	73	0.690	0.060	0.096	0.053
	16	25 0021	5.3	11.9		188	7.80	74	0.720	0.080	0.089	0.054
	16	25 0028	5.3	12.2		190	7.80	74	0.680	0.050	0.095	0.054

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/06/26	18	15 0000	21.6J
72/08/26	15	10 0000	2.8J
72/11/03	16	25 0000	17.1J

J VALUE KNOWN TO BE IN ERROR

APPENDIX C

TRIBUTARY DATA

STORET RETRIEVAL DATE 74/10/02

5546A1 LS5546A1
44 56 00.0 091 53 30.0
RED CEDAR RIVER
55 15 MENOMINIE
O/TAINTER LAKE
CO RD BRDG AT CEDAR FALLS BELOW DAM
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/24	09 12		0.269	0.350	0.125	0.010	0.120
72/10/23	15 30		0.570	0.520	0.032	0.060	0.120
72/11/28	11 10		0.950	0.400	0.022	0.066	0.105
72/12/21	12 00		1.060	0.580	0.110	0.069	0.105
73/01/28	13 00		1.100	0.690	0.168	0.090	0.140
73/02/23	13 00		1.200	0.370	0.090	0.085	0.115
73/03/22	12 00		0.710	0.810	0.200	0.066	0.135
73/04/07	13 00		0.630	0.910	0.016	0.047	0.105
73/04/23	14 15		0.430	0.780	0.030	0.046	0.105
73/05/14	14 00		0.370	2.300	0.041	0.056	0.120
73/05/29	13 05		0.360	0.900	0.090	0.069	0.145
73/06/28	17 30		0.270	2.500	0.105	0.036	0.100
73/07/23	17 15		0.056	0.870	0.154	0.052	0.110
73/09/11	06 40		0.019	1.260	0.980	0.090	0.150

STORET RETRIEVAL DATE 74/10/02

5546A2 LS5546A2
45 00 30.0 091 45 30.0
RED CEDAR RIVER
55 15 RIDGELAND
T/TAINTER LAKE
S OF JCT CO RD N ST HWY 170
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/24	11 30		0.373	0.400	0.124	0.012	0.150
72/10/23	16 20		0.770	0.460	0.029	0.090	0.170
72/11/28	12 00		0.970	0.380	0.032	0.089	0.130
73/01/28	14 00		1.140	0.790	0.147	0.120	0.165
73/02/23	14 00		1.100	0.400	0.110	0.120	0.155
73/03/22	13 10		0.740	0.660	0.132	0.072	0.090
73/04/07	14 30		0.890	1.470	0.022	0.087	0.135
73/04/23	15 05		0.500	0.735	0.019	0.083	0.115
73/05/14	16 00		0.270	1.000	0.029	0.078	0.137
73/05/29	13 15		0.315	0.940	0.031	0.080	0.155
73/06/28	18 20		0.750	1.600	0.065	0.147	0.200
73/07/23	18 00		0.520	0.400	0.037	0.160	0.210
73/09/11	07 15		0.240	0.500	0.018	0.130	0.185

STORET RETRIEVAL DATE 74/10/02

5546A3 LS5546A3
45 00 30.0 091 44 00.0
RED CEDAR RIVER
55 15 NEW AUHURN
I/TAINTER LAKE
ST HWY 170 BRDG N COLFAX ABOVE STP
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/24	11 00		0.174	0.500	0.073	0.007	0.147
72/10/23	16 00		0.720	0.540	0.022	0.079	0.145
72/11/28	11 50		0.900	0.390	0.008	0.075	0.110
72/12/21	12 00		1.000	0.440	0.115	0.033	0.129
73/01/28	13 45		1.300	0.700	0.078	0.054	0.155
73/02/23	13 30		1.100	0.700	0.126	0.110	0.145
73/03/22	12 50		0.710	1.260	0.130	0.069	
73/04/07	13 30		0.860	0.500	0.015	0.078	0.120
73/04/23	14 00		0.430	1.260	0.025	0.072	0.115
73/05/14	16 00		0.240	1.380	0.038	0.066	0.120
73/05/29	15 00		0.300	0.980	0.033	0.068	0.140
73/06/28	18 10		0.720	1.540	0.039	0.132	0.185
73/07/23	17 50		0.470	1.050	0.027	0.150	0.195
73/09/11	07 10		0.620	0.440	0.014	0.123	0.180

STORET RETRIEVAL DATE 74/10/02

5546R1 LS5546R1
44 58 00.0 091 52 30.0
LAMA CREEK
55 15 MENOMINIE
T/TAINTER LAKE
CO RD XING OFF ST HWY25 NNEN MENOMONIE
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/26	09 40		0.240	0.850	0.038	0.005K	0.095
72/10/23	15 45		0.100	0.750	0.021	0.086	0.135
72/11/29	11 20		0.740	2.200	0.034	0.030	0.120
73/03/22	12 20		0.350	0.690	0.038	0.038	
73/04/07	13 30		0.210	0.630	0.015	0.028	0.040
73/04/23	14 30		0.029	2.700	0.072	0.036	0.055
73/05/14	14 00		0.010K	0.780	0.017	0.040	0.055
73/05/29	13 00		0.038	1.320	0.060	0.066	0.095
73/06/28	17 45		0.105	1.760	0.042	0.120	0.160
73/07/23	17 30		0.049	1.400	0.026	0.092	0.185
73/09/11	06 45		0.198	0.850	0.044	0.096	0.135

K VALUE KNOWN TO BE LESS THAN INDICATED

STORET RETRIEVAL DATE 74/10/02

5546C1 LS5546C1
45 02 30.0 091 52 30.0
HAY RIVER
55 15 RIDGELAND
T/TAINTER LAKE
ST HWY 170 4BDG 1.5 MI E WHELER
11PALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 4-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/09/24	11 45		0.922	0.600	0.059	0.009	0.088
73/10/23	16 50		0.860	0.610	0.016	0.042	0.095
73/11/28	12 15		1.240	0.190	0.014	0.029	0.072
73/12/21	13 00		1.320	1.100	0.066	0.032	0.072
73/01/28	08 00		1.120	0.680	0.120	0.105	0.105
73/02/23	14 30		1.300	0.280	0.024	0.043	0.079
73/03/22	11 40		1.120	0.660	0.138	0.060	
73/04/07	14 00		0.900	0.440	0.009	0.030	0.075
73/04/23	15 25		0.790	0.380	0.007	0.046	0.086
73/05/29	16 00		0.830	0.880	0.048	0.062	0.135
73/06/28	18 30		0.920	2.100	0.056	0.050	0.114
73/07/23	18 10		0.920	0.440	0.013	0.060	0.115
73/09/11	07 25		1.120	0.685	0.024	0.066	0.115

STORET RETRIEVAL DATE 74/10/02

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 554601           LS554601
45 00 30.0 091 44 00.0
18 MILE CREEK DAM
55       15 NEW AUBURN
STAINTER LAKE
CITY TRK G HROG JCT ST HWY 170 COLFAX
11EPALES                  2111204
4                         0000 FEET  DEPTH
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DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/09/24	11 15		0.892	0.350	0.240	0.041	0.330
73/10/23	16 15		1.300	1.945	0.510	0.025	0.470
73/11/28	11 30		1.500	0.180	0.027	0.231	0.294
73/03/22	12 40		2.060	0.480	0.077	0.189	0.195
73/04/07	13 30		1.780	0.690	0.028	0.198	0.230
73/04/23	14 55		1.520	2.200	0.072	0.220	0.250
73/05/14	15 00		1.440	0.870	0.018	0.180	0.240
73/05/29	14 30		1.320	1.030	0.105	0.390	0.500
73/06/28	18 05		1.540	2.040	0.115	0.250	0.330
73/07/23	17 40		1.540	1.150	0.036	0.270	0.360
73/09/11	07 00		1.640	0.350	0.023	0.260	0.340